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WAR FOOD ADMINISTRATION

COMPARATIVE MANUFACTURING PERFORMANCE AND FIBER PROPERTIES OF
CERTAIN LONG-STAPLE COTTONS

U.S.
Prepared by the
Food Distribution Administration 1/

Cotton farmers, marketing agencies, and cotton manufacturers have frequently expressed the need for factual information regarding the relative qualities of S x P, an American-Egyptian variety, and Wilds 13, a long-staple American upland type cotton. There also has been considerable discussion between agricultural and trade groups concerning the relative quality of these and certain imported Egyptian, Anglo-Egyptian Sudan, and Peruvian varieties. This study was undertaken for the purpose of furnishing reliable information that would be helpful in arriving at conclusions with respect to the comparative manufacturing value of these cottons. The results here reported should be of special interest at this time because of the wide use being made of long-staple cottons in the manufacture of war materials, such as airplane fabric, balloon cloth, parachute straps, sewing thread, and other materials requiring both lightweight and excellent strength.

PURPOSE OF STUDY

Important points upon which there has been need for information regarding long-staple cottons are: (1) The comparative yarn strength and appearance; (2) comparative manufacturing waste; and (3) relative facility of processing.

The American growths of cotton included in this study were produced near Pecos, Tex., and Sacaton, Ariz., during the 1942 season. At Sacaton, the spinning lots were harvested from fields used to increase pure seed stocks while the Pecos growths represent commercial plantings. Spinning lots of Egyptian, Sudan, and Peruvian cottons were made up of samples from representative bales imported for use in specialty goods

1/ The spinning and fiber tests on which this report is based were made in the laboratories of the Food Distribution Administration at Clemson, S. C., in cooperation with the Clemson Agricultural College and the Bureau of Plant Industry, Soils, and Agricultural Engineering. X-ray measurements were made by the Bureau of Plant Industry, Soils, and Agricultural Engineering at Beltsville, Md.

and were, therefore, considerably higher in quality than the average produced in those countries. Cottons comprising this test were roller ginned with the exception of Wilds 13, grown at Pecos, Tex., and Peruvian Tanguis which were saw ginned.

A new variety of American-Egyptian cotton, designated as SP x Sak 35, was included with the samples tested from Sacaton. This variety, though still in a developmental stage, has been increased sufficiently to permit a commercial mill test and appears to be an excellent cotton, but seed stocks will not be released until further tests are made and yield data obtained.

Approximately two-thirds of the Egyptian and Anglo-Egyptian Sudan cotton consumed in the United States is of the Giza 7 variety. The other third consists largely of Sudan L (Lambert) and Sudan S (Sakel), Karnak, Sakha 4, Malaki, and Maarad varieties.

DESCRIPTION OF TESTS

Each cotton was manufactured on standard commercial equipment in accordance with the laboratory methods used for processing small lots of long-staple cotton. A light picker treatment was used and the cottons were carded in accordance with the usual commercial practice for cottons of this length. Comber settings were the same for the SP x Sak 35, S x P, and Peruvian Pima, but for the other cottons the setting of the cushion plate to detacher roll was decreased from 0.53 inch to 0.45 inch. Roving and spinning frames were of the regular draft type.

Warp yarns were spun with the optimum twist required to give maximum strength as measured by the skein method. Twists were determined by estimating the optimum twist and spinning and testing yarns made with two lesser and two greater twists. From these data the true optimum twist was determined for each cotton and the same twist multiplier was used in spinning the 60s, 80s, and 100s yarns.

During each manufacturing process, notes were made in regard to the running qualities of the cottons, such as the appearance of the card and drawing webs, flyings, and ends down at the spinning frame. The processing quality of each of the cottons was evaluated on the basis of these notes and general observations.

A portion of the yarns from two of the three counts spun was wound on black boards and graded in accordance with standards for yarn appearance developed in the Department of Agriculture in cooperation with the American Society for Testing Materials.

Physical tests were made in the fiber laboratory to measure certain characteristics of the cottons. The usual techniques employed

in the fiber testing laboratory were followed in making fiber tests on small representative samples of each cotton.

RESULTS

All cottons in this test were graded and stapled by the Appeal Board of Review Examiners, Washington, D. C. Grades were based on the standards for American-Egyptian cotton, with the exception of the Wilds 13 and Peruvian Tanguis which were graded in accordance with the standards for American upland cotton. Classification results in the accompanying table show that the S x P cotton was somewhat longer than the Egyptian and Sudan cottons and about equal in length to the Peruvian Pima. This length relationship is also shown by the laboratory fiber measurements reported in the accompanying table.

The average comber waste was higher for the Egyptian growths, the Sudan L, and Peruvian Pima than for the S x P samples. Notwithstanding the lower comber waste removed from the S x P cottons, they were spun into stronger yarns on the average than the others in the test. The S x P and SP x Sak 35 cottons were spun into 60s yarn with an average skein break 14 percent stronger than the average of those made from the Egyptian and Sudan growths. The S x P and SP x Sak 35 were found to be 16 percent stronger than the Egyptian and Sudan cottons for 80s yarn and 18 percent stronger for 100s yarns. Probably this was owing to the fact that the American-Egyptian growths were longer fibered. It should be added that previous tests on shorter stapled cotton have shown that within normal limits an increase of 2 percent in comber waste removed from a given cotton will increase yarn skein strengths approximately 1 percent. ^{2/} Therefore, had the amount of comber waste removed been increased for the S x P to a figure comparable to the average removed from the other cottons in the test, undoubtedly this variety would have shown even higher yarn strengths than those here reported.

Manufacturing waste removed by the pickers and card from the Wilds 13 variety was greater than that from S x P and most of the imported varieties. This higher waste reported for Wilds 13 in the accompanying table was, of course, not unusual as the grades were somewhat lower. The Peruvian Tanguis variety was quite free of foreign matter, having been graded Good Middling spotted and the picker and card waste was relatively low. Waste removed at these processes was much less for Tanguis than for the No. 1 grade Giza 7 sample, the two shorter-fibered cottons tested.

Peruvian Pima was manufactured into yarns having higher skein breaks than the average for the Egyptian varieties. The shorter and coarse fibered Tanguis variety, however, made considerably weaker yarns than any of the other cottons in the test.

^{2/} Campbell, Malcolm E., and John M. Cook. Effects of varying the percentage of comber waste on the quality of cotton yarn. U. S. Dept. Agr., May 1943 (mimeographed).

Cotton classification, spinning and fiber test results for certain American, Egyptian, Sudan, and Peruvian long-staple cottons

Place grown and variety	Classification	Spinning test results										Fiber test results																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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yarn	1920s yarn	1940s yarn	1960s yarn	1980s yarn	2000s yarn	2020s yarn	2040s yarn	2060s yarn	2080s yarn	2100s yarn	2120s yarn	2140s yarn	2160s yarn	2180s yarn	2200s yarn	2220s yarn	2240s yarn	2260s yarn	2280s yarn	2300s yarn	2320s yarn	2340s yarn	2360s yarn	2380s yarn	2400s yarn	2420s yarn	2440s yarn	2460s yarn	2480s yarn	2500s yarn	2520s yarn	2540s yarn	2560s yarn	2580s yarn	2600s yarn	2620s yarn	2640s yarn	2660s yarn	2680s yarn	2700s yarn	2720s yarn	2740s yarn	2760s yarn	2780s yarn	2800s yarn	2820s yarn	2840s yarn	2860s yarn	2880s yarn	2900s yarn	2920s yarn	2940s yarn	2960s yarn	2980s yarn	3000s yarn	3020s yarn	3040s yarn	3060s yarn	3080s yarn	3100s yarn	3120s yarn	3140s yarn	3160s yarn	3180s yarn	3200s yarn	3220s yarn	3240s yarn	3260s yarn	3280s yarn	3300s yarn	3320s yarn	3340s yarn	3360s yarn	3380s yarn	3400s yarn	3420s yarn	3440s yarn	3460s yarn	3480s yarn	3500s yarn	3520s yarn	3540s yarn	3560s yarn	3580s yarn	3600s yarn	3620s yarn	3640s yarn	3660s yarn	3680s yarn	3700s yarn	3720s 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52)	(853)	(854)	(855)	(856)	(857)	(858)	(859)	(860)	(86

1/ Grades are based on the standards for American-Egyptian cotton with the exception of the Wilds 13 and Tanguis varieties which are based on grades for American upland cotton.

2/ Appearance grades based on standards adopted as tentative by the American Society for Testing Materials. A is the highest grade, followed by A-, B+, B, B-, C+, C, etc.

3/ Differences between means of approximately 2,700 pounds are required for significance (odds of 19 to 1).

4/ 1942 crop.

5/ This variety is in the developmental stage and seed are not ready for general distribution.

6/ Test samples taken from commercial bales.

Food Distribution Administration, Cotton and Fiber Branch.

A comparison of the two domestic growths showed that the S x P variety gave a 20 percent higher skein break than the shorter Wilds 13 variety when spun into 60s yarns. This difference in yarn strength, based on averages of the three S x P cottons and two Wilds 13 cottons tested, is too great to permit a satisfactory substitution of Wilds for S x P in goods requiring excellent strength.

Comparing the skein strength of Wilds 13 with that for the widely used Giza 7, it was found that in one instance Wilds 13 is better and in the other Giza 7 is superior. Giza 7 made stronger yarns than the average of the two Wilds cottons in the coarser counts, but in the finest count the longer-fibered Wilds was superior. Had the amount of comb waste removed from the Wilds 13 grown at Pecos been increased to equal that removed from Giza 7, even this Wilds sample probably would have made yarns about equal in strength to the Giza 7.

Yarn appearance is also a very important factor to be considered in the manufacture of fine goods. It is, therefore, worth while to consider the more important factors that go to make up yarn appearance. Neps are particularly undesirable in yarns that go into balloon cloth and sewing thread. They show up readily in the yarns, particularly in the finer counts, but when yarns are plied, neps are somewhat less noticeable. To compare the cottons for neppiness, portions of the card web were removed intermittently during the carding process and the neps counted. These results in terms of the average number of neps found per square inch of web are shown in column 9 of the table. Other factors of perhaps less importance in determining yarn appearance grades are foreign matter, evenness, and freedom from excessive fuzz fibers. Appearance grades were determined in accordance with the yarn appearance standards. The results for 60s and 100s yarns are shown in columns 10 and 11 of the accompanying table. In general, it was found that the better appearing yarns were made from those cottons having the fewer neps in the card web.

The mature fibered Giza 7 variety had the fewest neps and highest yarn appearance grades in the test. The S x P variety compared favorably in yarn appearance with the Sudan and Peruvian cottons and with all except Giza 7 of the Egyptian cottons. The SP x Sak 35 sample was somewhat neppy but made yarns of satisfactory appearance. This variety is suitable for use in very fine counts as shown by the skein strengths which are definitely superior to all other samples in the test. Only Giza 7 and one of the S x P samples made 100s yarns of better appearance than SP x Sak 35. Peruvian Pima was the poorest sample tested from the standpoint of card web neppiness and yarn appearance.

Wilds 13 was relatively free of neps and made 60s yarn having good appearance but the 100s made from this variety graded C+, which is slightly rough. Large quantities of these long staple cottons are used for making yarns ranging around 60s. The Wilds 13 variety could satisfactorily be substituted for some of the imported growths. But, because

of the rather rough appearance of the 100s yarn spun from Wilds and its lower yarn strengths, this cotton could not be substituted successfully for the stronger and smoother S x P in manufacturing finer counts of yarn.

No difficulty was experienced during the manufacturing processes with any of the cottons except Peruvian Tanguis. This variety was made into 60s satisfactorily but end breakage on 80s was high and on 100s it was excessively high. The other cottons had very little or no end breakage even on 100s yarns. In reporting on the performance of the various growths during manufacturing, the laboratory technologists made the general observation that the Egyptian and Sudan growths seemed to process slightly better than the others.

Analyses of fiber properties were made to determine length, fineness, percentage of thin-walled fibers, tensile strength, and cellulose alignment by the X-ray method. The results of these tests, shown in the accompanying table, are of interest in characterizing the cottons and in explaining to some extent the spinning results.

Egyptian and Sudan cottons were, on the average, not as fine-fibered as was the S x P variety, but finer than the Wilds 13. Peruvian Pima was about the same in this respect as S x P but the Tanguis variety, one of the shorter cottons in the test, was considerably coarser-fibered. The Giza 7 sample had the fewest thin-walled or undeveloped fibers of the varieties tested and would be classed as mature-fibered. The percentages of thin-walled fibers in the other samples were within the range expected for normal cottons.

Fiber tensile strength was slightly better for SP x Sak 35 than for any of the other cottons as shown by the results in column 15 of the table. The good fiber strength of this new variety is confirmed by the small X-ray angle, a characteristic that is indicative of good strength. The next best cotton with respect to fiber tensile strength was Wilds 13 which averaged a little stronger than the Egyptian or Sudan cottons. S x P had a lower fiber strength than the average of any of the imported growths.